SPECIFICATION

SafeSite™ Integrated Critical Mission Fuel Transfer System (CMFTS)

1.0 GENERAL DESCRIPTION AND STANDARDS

1.1 Controls shall be provided and designed to continuously monitor and control the level of fuel in the day/belly tanks, provide leak detection and alarms for all tanks and piping, as well as control of pumps and valves for critical emergency power applications.

1.2 The base CMFTS shall integrate up to the following into one system: (10) main storage tanks including tank monitoring; (10) day/belly tanks including tank monitoring; (5) duplex pump set; (10) return pump assemblies; (10) boiler feeds; header feed controls; automatic pump alternation sequencing; pump motor status monitoring; automatic fuel polishing; and piping and piping sump monitoring.

1.3 The CMFTS controller shall bear the inspection labels of the Underwriters Laboratories (UL508A). The system shall comply with NFPA 70 and NFPA 30, 31, 37, 110 IFC 34 & 6 and labeled accordingly for its intended use.

1.4 Acceptable Manufacturer: SafeSite CMFTS Integrated Critical Mission Fuel Transfer System as configured and supplied by: Core Engineered Solutions, Inc.

2.0 DESIGN AND CONSTRUCTION

2.1 CONTROLLER: The CMFTS controller shall include a NEMA 4X stainless steel 304 enclosure with the following components:

2.1.1 The enclosure will be capable of being wall mounted or floor mounted if required. The minimum size of the enclosure will be 36"Hx36"Wx12"D; Single door with 3-point lockable latching mechanism.

2.1.2 Microprocessor programmable logics control (PLC) shall be DirectLOGIC 205 Series PLC with a DL260 CPU Module, including DL205 Local Base Expansion for up to four additional bases with the following features:

2.1.2.1 RLL/RLLPLUS programing, real time clock and calendar, (2) RS232 ports, DirectNET Master-Slave RS-422, Modbus RTU Master-Slave RS-485/RS-422, and ASCII in-out.

2.1.2.2 Requires DirectSOFT software 4.0 or later.

2.1.2.3 DL205 communication module to include: (1) Ethernet, 10/100 Base-T RJ45 port.

2.1.2.4 Microprocessor controlled, three built-in communication ports (two rs-232 ports and one rs-485 port).

2.1.2.5 Microprocessor shall be capable of monitoring and controlling 1024 inputs and 1024 output signals.

2.1.3 The CMFTS controller functionality shall integrate the following capabilities:

2.1.4 Motor starter controls or each pump, including:

2.1.4.1 Duplex supply pumps
2.1.4.2 Return pumps
2.1.4.3 Pump leak sensors
2.1.4.4 Pressure vacuum sensors

2.1.5 The CMFTS system must be capable of interfacing and receiving levels from an external, third-party tank monitoring system.

2.1.6 The CMFTS system must be capable of monitoring the status of the mechanical line leak detectors (MLLD) for underground storage tank systems (UST) and only open the valves when the MLLD's are fully open and the piping system has been tested/verified to be leak free. In the event that the MLLD fails the system will not open the selected valve. It will cause an alarm and automatically lockout the system until the system is manually reset.

2.1.7 Monitoring the main storage tanks:

2.1.7.1 90% high level alarms (programmable)
2.1.7.2 85% high level warnings (programmable)
2.1.7.3 25% low level warnings (programmable)
2.1.7.4 10% low level alarms (programmable)
2.1.7.5 Interstitial leak alarms
2.1.7.6 Piping sump sensors
2.1.7.7 Continuous level – gallons, inches and tank percent
2.1.7.8 Anti-syphon valve with flow sensor
2.1.7.9 Suction valves with flow sensor
2.1.7.10 Return valve with flow sensors (multiple tanks)

2.1.8 Monitoring day/belly storage tanks:

2.1.8.1 90% high level alarms (programmable)
2.1.8.2 85% high level warnings (programmable)
2.1.8.3 Normal product level (programmable)
2.1.8.4 65% low level warnings (programmable)
2.1.8.5 60% low level alarms (programmable)
2.1.8.6 Interstitial leak alarms
2.1.8.7 Piping sump sensors
2.1.8.8 Supply valves with flow sensors
2.1.8.9 Return pumps with flow sensors

2.1.9 Monitoring Header-reservoir system:

2.1.9.1 Low level indication (programmable)
2.1.9.2 Normal level indication (programmable)
2.1.9.3 Pressure status
2.1.9.4 Flow status
2.1.9.5 Interstitial or containment leak alarms
2.1.9.6 Generator or boiler *call for fuel status*
2.1.9.7 Vent overflow status
2.1.9.8 Return to tank flow status
2.1.9.9 Piping leak sensor
2.1.9.10 Safety fire valve status

2.1.10 Monitoring Duplex filtration systems:

       2.1.10.1 Differential pressure alarm
       2.1.10.2 Water in filter alarm
       2.1.10.3 Enclosure leak alarm
       2.1.10.4 Main tank fuel polishing
       2.1.10.5 Day/belly tank fuel polishing
       2.1.10.6 Inline flow sensors
       2.1.10.7 Water containment high level alarm status
       2.1.10.8 Water containment high level warning status

2.2 TOUCH SCREEN DISPLAY: The Graphic interface Touch screen display (HMI) with 10" Color TFT LCD shall be C-more EA9 Series with the following features:

    2.2.1 Graphic interface Touch screen display (HMI) with 10.1" diagonal color TFT (thin film, transfer) LC display with 16.7M colors, 1024 x 600 pixel high resolution.

    128MB ram, 300 nits display brightness, 50,000 hour average backlight lifetime.

    2.2.2 User replaceable analog resistive (1024 x 1024) touch screen.

    2.2.3 USB 2.1 , Wi-Fi WPA-PSK/WPA2-PSK encryption, Ethernet 10/100 base-t port, (program/download & plc communication), remote internet access, serial PLC interface (Wi-Fi IEEE 802.11 b/g/n, Ethernet 10/100, rs232/422/485) (program/download & plc communication)

    2.2.4 BACnet for building automation and control networks, built-in real time clocks, graphic HMI's built-in VNC server and FTP server, backup data log files saved to an attached USB drive, e-mail and SMS alarm messages.

    2.2.5 NEMA 4/4X, IP65 compliant

    2.2.6 Certifications: UL, ULC, CE, RoHS

    2.2.7 The CMFTS systems HMI touch screen(s) shall be capable of displaying the follow:

       2.2.7.1 Main Tank:
           2.2.7.1.1 Gallons.
           2.2.7.1.2 Inches.
           2.2.7.1.3 Percent.
           2.2.7.1.4 Supply/Return Pump Flow Switch Status.
           2.2.7.1.5 Leak Sensor Status.
           2.2.7.1.6 H-O-A Selector Switch Position
           2.2.7.1.7 Supply/Return Valve Status

       2.2.7.2 Day/Belly Tanks:
           2.2.7.2.1 90% High Level Status.
           2.2.7.2.2 85% Pump Stop Level Status.
           2.2.7.2.3 Normal Level Status
           2.2.7.2.4 60% Pump Start Level Status.
           2.2.7.2.5 50% Low Level Status.
           2.2.7.2.6 Pipe Flow Switch Status.

2.2.7.2.7   Leak Sensor Status.

2.2.7.2.8   H-O-A Selector Switch Position.

2.2.7.2.9   95% Return Pump Start Status.

2.2.7.2.10   70% Return Pump Stop Status.

2.2.7.2.11   Supply Flow Switch Statu

2.2.7.3 Boilers:
- **2.2.7.3.1**   H-O-A Selector Switch Position
- **2.2.7.3.2**   Boiler Ready

2.2.7.4 Header-Reservoir Systems:
- **2.2.7.4.1**   H-O-A Selector Switch Position
- **2.2.7.4.2**   Low Level Warning
- **2.2.7.4.3**   Low Level Alarm
- **2.2.7.4.4**   Vacuum Break Line Overfill Status
- **2.2.7.4.5**   Interstitial or Containment Leak Alarm
- **2.2.7.4.6**   Return Flow Status
- **2.2.7.4.7**   High Pressure Status

2.2.7.5 Supply Pumps:
- **2.2.7.5.1**   Pump On Status.
- **2.2.7.5.2**   Motor Starter Status.
- **2.2.7.5.3**   Motor Overload (MCP) Status.
- **2.2.7.5.4**   Hour Meter.
- **2.2.7.5.5**   Pipe Flow Switch Status.
- **2.2.7.5.6**   H-O-A Selector Switch Position.

2.2.7.6 Return Pumps:
- **2.2.7.6.1**   Pump On Status.
- **2.2.7.6.2**   Motor Starter Status.
- **2.2.7.6.3**   Motor Overload (MCP) Status.
- **2.2.7.6.4**   Hour Meter.
- **2.2.7.6.5**   Pipe Flow Switch Status.
- **2.2.7.6.6**   H-O-A Selector Switch Position.

2.2.7.7 Filtration System:
- **2.2.7.7.1**   H-O-A Selector Switch Position
- **2.2.7.7.2**   Pressure Differential Status
- **2.2.7.7.3**   Water in Filter Status
- **2.2.7.7.4**   Pipe Flow Switch Status
- **2.2.7.7.5**   Enclosure Leak
- **2.2.7.7.6**   Solenoid Valve Status
- **2.2.7.7.7**   Water Containment Level Status

2.2.7.8 Mechanical Line Leak Detection:
- **2.2.7.8.1**   System Pressure
- **2.2.7.8.2**   MLLD Status
- **2.2.7.8.3**   MLLD Test Results

2.2.7.9 Alarms: Present and Historical:

2.2.7.9.1 System Warnings (all).

2.2.7.9.2 System Alarms (all).

2.2.7.9.3 System Out of Service Alarm.

2.2.7.9.4 Not in Auto Mode Warning.

2.2.7.9.5 In Manual Mode Warning.

2.2.7.9.6 Emergency Stop Depressed Alarm.

2.2.7.9.7 Call for Fuel Alarm.

2.2.7.9.8 Emergency Manual Mode Selected Alarm.

2.2.7.9.9 Main Tank High Levels.

2.2.7.9.10 Main Tank High Warnings.

2.2.7.9.11 Main Tank Low Level Warnings.

2.2.7.9.12 Main Tank Low level Alarms.

2.2.7.9.13 Main Tank Leak Alarms.

2.2.7.9.14 Main Tank Low Flow Alarms.

2.2.7.9.15 Day Tank High Level Alarms.

2.2.7.9.16 Day Tank Low Level Alarms.

2.2.7.9.17 Day Tank Leak Alarms.

2.2.7.9.18 Day Tank Low Flow Alarms.

2.2.7.9.19 Day Tank Return Pump Activated Alarm.

2.2.7.9.20 Filter Differential Warning

2.2.7.9.21 Filter Water Warning

2.2.7.9.22 Filter Leak Alarm

2.2.7.9.23 Filter Low Flow Alarms.

2.2.7.9.24 Pump Trouble Alarm.

2.2.7.9.25 Pump Failure Alarm.

2.2.7.9.26 Pump Low Flow Alarm.

2.2.7.9.27 Pump Enclosure Leak Alarm.

1. Return Pump Activated Alarm.
2. MLLD and Test Results
3. Piping Sump Leak Alarms (all).

2.3 SURGE PROTECTION AND EMERGENCY STOP: Surge protection to be designed to protect against the full spectrum of transient disturbances and filter the entire sine wave. Filters are designed to react instantly to changes in voltage regardless of phase angle or polarity. Effective against both low- and high-energy transients to prevent immediate damage and failure of electronics. Components to include:

2.3.1 Circuit breaker protection (fuses not allowed) shall be C trip curve, 10kA short circuit current rating, 35mm DIN rail mount, thermal magnetic trip and suitable for reverse feed and HVAC(R) applications.

2.3.2 Power transformer.

2.3.3 110db buzzer and strobe.

2.3.4 "Hand-Off-Auto" switches for all pumps and valves. Magnetic motor starters for all pumps. Motor circuit protectors for all pumps.

2.3.5 Emergency Stop power to all pumps and valves. Keyed emergency manual override switch to bypass all PLC-logic and send direct power to all pump motor starters and valves through isolation relays.

2.3.6 GFI receptacle for laptop.

3.0 OPERATIONS

3.1 The CMFTS system shall consist of controls that house all the components necessary to monitor and control the complete fuel oil system for the emergency generators including, and not limited to the main storage tanks, day tanks, the fuel oil supply and return pumps, and the fuel polishing system in relation to the entire project. The system will have one incoming power source, and is housed in one single enclosure. The system shall be a duplex lead pump control system. The system shall have three modes of operation as per the following:

3.2 Full Auto Mode – the system shall maintain the fuel level in all day/belly tank(s) between 65% (pump start) - 85% (pump stop) full capacity of each day tank. The lag pump will automatically come on if the level in any day/belly tank falls below 50% or if the lead pump registers a low flow alarm.

3.3 Supervised Manual Mode – the pumps will not automatically start, all alarms and warning are still monitored. Each pump will have to be placed in the hand position to operate and the system will monitor the day/belly tank levels and shut off all pump if any day tank reaches 90% (high level alarm).

3.4 Emergency Manual Keyed Mode – the alarm will sound and strobe will flash, the pumps will not automatically start in this mode. All warnings and alarms are still monitored. When an H-O-A selector switch is placed in the hand position the corresponding device (pump and/or valve) will activate without PLC control. Power shall be sent directly to each pump motor starter and/or solenoid valve in the system. Each device circuit shall be protected by a relay. The operator assumes full responsibility of all levels. The mode is for use only in the case of PLC failure.

3.5 Programmable System Parameters – The CMFTS system shall be capable of making parameter modifications without the use of a computer. The following parameters shall be password protected and must be able to be modified on the HMI touch screen:

3.5.1   System time and date (24 hour clock).
3.5.2   Periodic maintenance reminders (day/month).
3.5.3   Main tank hi level alarm percent set points.
3.5.4   Main tank high level warning percent set points.
3.5.5   Main tank low level warning percent set points.
3.5.6   Main tank low level alarm percent set points.
3.5.7   Main tank level probes setup and calibration.
3.5.8   Main tank profile types selectable from (horizontal cylindrical, rectangular, or vertical cylindrical).
3.5.9   The system must be able to perform math functions to convert inches to gallons for all three tank profile types.
3.5.10 Add or subtract main or day tank leak sensors.
3.5.11 Add or subtract piping leak sensors.

1. Seven-day filtration circulation schedule (day, time, duration) one entry per tank.
2. Lead pump select.
3. Main tank selection for automatic fill of day/belly tanks
4. Time delay of flow sensors before alarm
5. Set points to test the MLLD's for operation and test results

4.0 COMMUNICATIONS

4.1 The CMFTS system shall be capable of the follow remote communications capable of interfacing with building management systems (BMS):

4.1.1   ModBus or BACnet via Ethernet/RS232/422/485. System Summary Alarms (4 dry)

       4.1.2   Critical system alarm summary.

       4.1.3   Non critical system warning summary.

       4.1.4   Emergency Stop button depressed.

       4.1.5   System not in full Auto Mode Alarm.

4.2 The CMFTS system shall act as a Virtual Network Computing (VNC) server and a File Transfer Protocol (FTP) server. The operator shall have access to the system via remote communication to the HMI with a computer, cell phone or other device equipped with the VNC client application. The VCN shall be multilevel password protected.

4.3 The CMFTS system shall be capable of being remotely monitored and programmed through an encrypted Ethernet connection via external Ethernet, Wi-Fi, 3g/4g/LTE modem via a central M2M communication server (VNC/RDP) with NIST SP800-115 & ISECOM OSSTMM security.

5.0 INSTALLATION The CMFTS System hardware and software shall be fully tested and ready for field installation. Final configuration to be performed by an authorized factory representative.

For drawings or more information contact Core Engineered Solutions at www.core-es.com

Phone: (800) 628-5502 | Fax: (703)563-0330 | Email: info@core-es.com